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I.—*Statistical Notes on some Experiments in Agriculture.*

COMMUNICATED by Frederick Purdy, Esq., Honorary Secretary of the Statistical Society, to Section F of the British Association, at Exeter, 1869:—

If the man who causes two blades of grass to grow in place of one, is a benefactor to the community, then he who produces four instead of one, has doubly benefitted the commonwealth. This, Mr. Lawes of Rothampstead has, we shall find literally, succeeded in accomplishing. As a scientific agriculturist Mr. Lawes is well known, and the last account of his experiments,—investigations that in some instances have been extended over twenty consecutive years,—is an admirable illustration of that patient questioning of nature which Bacon so strenuously enforced. The memoranda of the plan and results, which Mr. Lawes has circulated among his friends, give the issue of upwards of 1,400 separate experiments—not experiments that can be quickly performed like the ordinary ones of the laboratory —but experiments each requiring one revolution of the seasons for its answer.* It is beyond my scope to attempt a description of these researches in any detail, at the same time I hope to convey some idea of the extreme importance of Mr. Lawes's achievements, by selecting a few salient examples from each process of cultivation employed by that gentleman:—

Permanent Meadow Land.—The area experimented on was about 6¾ acres, divided into 20 plots—with few exceptions, duly noted, the same description of manure has been applied year after year to the same plot. The meadow land chosen "has been probably laid down in grass for some centuries." It is known that no fresh seed had been artificially sown for thirty years,—nor is there any record of an earlier sowing. When the experiments began, the herbage seemed uniform over all the plots. I take for this crop, and for the two grain crops which in the account follow, the yield of the *unmanured* ground, and compare it with the yield of that *manured* plot which furnished the *greatest* product.

The yield of the plots unnoticed here, range at various distances between the extreme results selected for comparison below.

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* *Memoranda of the Plan and Results of the Field Experiments conducted on the Farm of John Bennet Lawes, Esq., at Rothampstead, Herts.* May, 1869.

Experiments on Permanent Meadow Land.

	Produce per Acre Weighed as Hay.	
	Average of Thirteen Years, 1856-68.	1868 alone.
	cwts.	cwts.
Plot (11*a*) dressed with artificial manure, which afforded the *maximum* yield	64½	72¼
Average of two Plots (3 and 12) *unmanured* continuously during the thirteen years	24	20¾
Difference in favour of the manured Plot (11*a*)	40½	51½

Note.—The numbers in brackets after the plots, here and hereafter, refer to the enumeration of the original paper.

Taking the whole period under trial, the maximum plot gave a heavier product than the ground left to unaided nature, by 166 per cent. Last year the divergence was wider, for the assisted plot gave more, and the unassisted less than the average, the difference being 250 per cent. in favour of the former as against the latter. The artificial manures applied to the maximum plot were, sulphates of potass, soda, and magnesia; superphosphate of lime, ammonia salts, silicate of soda, and silicate of lime. For the quantities and periods of dressing, I must refer the Section to Mr. Lawes's paper, which goes into minute and exact scientific particulars.

Chemistry has taught agriculturists that their husbandry will not draw from the soil or the atmosphere what is neither in the soil nor in the atmosphere. The corollary of this lesson seems to have determined the operations on Plot No. 18. The ground was annually dressed with a mixture, per acre, equal to the respective quantities of potass, soda, lime, magnesia, phosphoric acid, silica, and nitrogen contained in a ton of hay. The average yield of hay for the four years 1865-68, was 32¼ cwt., or 8 cwt. in excess of the two unmanured plots represented in the table above. In 1868 the yield was 27½ cwt. or 6¾ cwts. above the produce of the unmanured plots in the same year—just *one-third* of the chemicals was returned to the cultivator by the surplus hay in this year's trial.

Barley.—The area under experiment was about 4½ acres, divided into 28 plots. The grain sown on the same land year after year, and, for the most part, the same manures used continuously on each plot.

Experiments on the Growth of Barley.

	Produce per Acre. Average of Seventeen Years, 1852-68.		
	Dressed Corn.		Total Straw.
	Bushels.	lbs. each.	cwts.
Plot [(4) 4 AAS] dressed with artificial manure, and affording the *maximum* yield	50½	52¾	33¼
Average of two Plots (1 O and 6 I) *unmanured* continuously during the seventeen years	21¾	52¼	12½
Difference in favour of the manured plot	28¾	½	20¾

The average yield during the seventeen years of the maximum barley plot, as against the unmanured plots, was 132 per cent. of dressed corn in excess. There was also an increase of weight of about 1 per cent. The proportionate increase of straw, viz., 166 per cent., was greater than the proportionate increase of grain. The dressing for the maximum plot was nitrate of soda, superphosphate of lime, mixed alkalies, and silicate of soda. A Plot (7) treated with farmyard manure in the concentrated form of *exuviæ*, at the rate of 14 tons per acre yearly, produced on the average of 1852-68, dressed corn 48 bushels of 54 lbs. each, the straw weighing 28¼ cwt. It is noticeable that this plot gave the heaviest weight per bushel of dressed barley. The seventeen years' mean weight per bushel being 52¾ lbs. off the other plots.

Wheat.—Area under experiment about 13 acres, made into 26 plots. Wheat sown on the same land, without intermission, for twenty-five years. Nearly the same description of manure on the same plot each year, especially during the last seventeen years, to which term the following experiments were limited:—

Experiments on the Growth of Wheat.

	Produce per Acre. Average of Seventeen Years, 1852-68.		
	Dressed Corn.		Total Straw.
	Bushels.	lbs. each.	cwts.
Plot [16 (*a* and *b*)] dressed with artificial manure, and affording the *maximum* yield	39½	58	46½
Average of two Plots (3 and 20) *unmanured* continuously during the seventeen years	14¾	57½	14
Difference in favour of the manured plot	24¾	½	32½

In relative, but not in absolute, excess, the maximum plot shows a larger result in wheat than in barley; in the former grain the excess is 168 per cent. The specific weight of grain here also shows but small increase over that grown on unmanured ground. The increase of straw is no less than 232 per cent. This maximum plot had from 1852-64, yearly, mixed alkalies, superphosphate, and at the rate per acre of 800 lbs., ammonia salts. A plot (2) treated with farmyard manure, at the rate of 14 tons an acre, gave on the average of seventeen years, 35½ bushels of dressed wheat of 60 lbs. per bushel, and 34 cwt. straw. Here again the natural manure must be credited with producing the heaviest bushel. It is seen that in 1868 the quantity grown on the maximum wheat plot was much below the average, being only 22¾ bushels per acre, but the weight was 62¾ lbs. to the bushel, or 4¾ lbs. above the seventeen years' average. But this year the comparative weights were all largely in excess of the mean. At the same time, the unmanured Plot No. 3, the one alone recorded for 1868 separately, gave 16¾ lbs. per acre, or 2 lbs. beyond the average produce of 1852-68.

There are a number of other patient trials in the growth of green crops and root crops narrated, whose more or less successful results Mr. Lawes has detailed in his paper. The issue of one which the experimenter regards as notable, I give it in his own words:—"In alternating wheat with beans," Mr. Lawes observes, "the remarkable result has been obtained, that nearly as much wheat and nearly as much nitrogen were yielded in eight crops of wheat in alternation with the highly nitrogenous beans, as in sixteen crops of wheat grown consecutively without manure in another field; and also nearly as much as were obtained in a third field in eight crops alternating with bare fallow."

I will conclude this sketch with an abbreviated account of a series of rotation experiments extending over twenty years, 1848-67 inclusively. An area of 2½ acres was divided into three plots, each was sown alike year by year, and in this order of succession:—First year, turnips; second year, barley; third year, beans; fourth year, wheat; the fifth, turnips; again and so on throughout the twenty years. Plot 1 was unmanured continuously. Plot 2, manured with phosphate of lime for the *turnips* only, consequently this was manured once in four years. Plot 3, treated with complex manure (artificial entirely) for the *turnips* only, and therefore once in four years like No. 2.

The average results for the corn and roots are given below; the straw and leaf produce is omitted.

Crops in Rotation.	Corn or Roots Produced on		
	Plot 1, Unmanured continually.	Plot 2, Superphosphate of Lime, for Turnips alone.	Plot 3, Complex Manures, for Turnips only.
1st. Swedish turnips .... cwts.	26½	136¼	242½
2nd. Barley .... bshls.*	41½	30½	44
3rd. Beans .... " *	12½	12¾	21½
4th. Wheat .... " *	33	30½	35½

* All dressed corn.

Plot 1 produced much less of turnips than the others, but the dressing of the turnips on Plot 2 apparently injured the barley much, and the wheat in smaller degree; the beans slightly affected. But on Plot 3, all the crops attained their *maxima;* the turnip produce was ninefold as against the gathering from the unmanured ground of Plot 1.

There are many other and important essays in experimental agriculture, concisely described by Mr. Lawes in the *Memoranda,* but which yielding unreadily to statistical illustration, I have refrained from touching.

II.—*The Changes in Agriculture in Cornwall since* 1800.

The following paper was read by Mr. John Thomas, of Pradannack, Mullion, at the last monthly meeting of the Helston Agricultural Exchange:—

"Almost the only field crops at the commencement of this century were *wheat, barley, and oats;* even potatoes were far from being so extensively cultivated as they were a quarter of a century afterwards; and as for turnips, which now fill such an important part in our cultivation, they were scarcely then known. The only manure available was what was made on the farm, with the exception of sand, where convenient for carrying, and lime in certain localities, and upon certain soils, marl was also used in favourable localities. Farms near the towns at this time were considered of greater proportionate value than they would be in the present day, for the facilities they afforded to obtain town dung; every kind of compost that could be got was carefully cleaned up, such as road scrapings, &c.; this was considered then, as it is now, beneficial for wheat. *Labour being low,* many things were then carried as manure which now would not be considered to pay. There being little or no turnips, and very little house or stall feeding, of course the farm-yard manure was little, and that of very inferior quality. Where straw was plentiful, it was thrown about the yards, such as they were, and a favourite way of preparing the dung was to heave it up in a high heap in the yard; this was to prevent cattle from treading on it, as it would rot down much faster in this way. The application of the dung was for wheat and barley, but then it was always rotten dung for barley—that is, twelve months' old top-dressing, for dressing on grass was then, I believe, scarcely ever adopted.

" The first thing I wish to notice in the way of cropping, is the cultivation of the *potato.* As I remarked before, at the commencement of this century this plant was cultivated little more than as a household vegetable, yet in a few years after it came to be so extensively cultivated, especially for fattening pigs, that when it began to fail from disease, it was felt to be a national calamity, and the farmer, for a long time, looked in vain for anything approaching to a substitute. It is singular that this root, said to have been introduced into Europe three centuries before, should not have come into general use before the time I speak of, and it is equally singular that it so soon showed symptoms of decay. I estimate about thirty or forty years as the period the potato was under extensive cultivation. *It is amusing to hear of the prejudice by which this root was received by our forefathers, who ascribed every calamity, whether natural or national, to its introduction.*

" The next thing which should claim our attention is the *root crop,* and under this head, of course, the turnip is the chief or most important. This produced a very great change in the rotation of crops, as well as the keeping of stock. I believe the turnip had been moderately cultivated in some counties before the date we have now under consideration; but in this county and this locality, it is not more than fifty or sixty years since the turnip may be said to have been cultivated for the use of stock. It felt its way in at first very slowly; the pioneer was the pasture turnip, and then followed the Swede or rutabaga. I believe I remember the first rutabaga cultivated in the parish in which I reside, and I have seen in that time the cultivation of the turnip increase from—if I were to say 1 to 10 per cent. of the land under cultivation, I suppose it would be a just approximation.

" There is another subject so intimately connected with the root crop, that we can scarcely speak of one without thinking of the other—you will anticipate that I mean the discovery of *new manures;* every other change sinks into nothing compared to this. Other changes have been more or less partial; this has been organic, and it has affected the whole; this may be regarded as a revolution, as affecting the very constitution of things; and had it not been for this revolution, the English farmer must have had a strong constitution indeed to have sustained some of the pressures that have been put on him. It is about thirty or thirty-five years since the introduction of those manures, and it is surprising in that time to what extent and how general they are become. The four principal of the manures to which I refer are *bone, guano, phosphates of lime, and nitrate of soda;* these are frequently called artificial manures, although art or science has had little to do with the two first, or with their discoveries as manures. It would be interesting to know who was the first to apply broken bones to plants; no doubt the discovery was made by observing how tenaciously the fibres of plants clung to pieces of bone in the soil. Any reflecting mind might have suggested the idea of breaking the food for the plant, and as to guano, which is a natural deposit, and had been used by the Peruvians for centuries, of course our traders to that part of the world would ascertain its fertilising properties. I was talking some time since with a gentleman who was the first that ever used guano in this county. He said he had been having artificial food for his cattle from a large house in London; they sent down a bag (2 cwt.) of this stuff, and said it produced wonderful effects in South America, and desired him to try it, to see if there was any good in it. He applied the 2 cwt. to one acre of oats, and the effect was wonderful—greater than he has ever seen from that time to the present. On the discovery of those new manures, the root crops may be said to have claimed them for their own, and the stimulus given to the growth of green crops was surprising.

If Science had not much to do with discovering new manures, Art has done a great deal by inventing the drill, horse-hoe, &c., without which those manures could not be economically applied, and it would be impossible for the crops to be cleaned. Before the introduction of green crops, a good summer's fallow for wheat was the only chance a farmer had to clean his land; but by the use of the drill, to be followed by the horse-hoe, two ends could be obtained at one time—cleaning the land and raising the crop. Although I may not be willing to admit that we owe so much to chemistry as some claim for that science, yet I conceive we are under immense obligations to the inventive genius of the mechanic.

" At the commencement of the present century, few and simple indeed were the *implements* of husbandry. The plough, harrow, stone roller, and tormentor may be said to comprise all the field implements. These were of a very rude description, compared with those of the present day, and when we think of the plough in use then, with its shoe-like share, put on to the wooden chip, it is surprising how well, in many instances, the work was accomplished. I think it would puzzle some of our best ploughmen in the present day to manage such implements at all. Great attention has been paid to the improvement of the plough, which must be regarded as the first or chief of agricultural implements, until it has arrived to that state of perfection and does its work with such precision that we might justly give it the distinguished title of a mathematical instrument. Not only has a great change been made in those implements which affect the culture of the land, but also in those which affect the *securing of crops*. The change here is marvellous indeed, when we think of the stride from the sickle or old reap-hook, to the graceful reaper drawn by horses and laying down the bundles in such quick succession. The change is equally great in those things which affect the preparing and returning the crops as those of cultivating and securing, within the memory of those who are past the middle age of life. The flail, or *threshall*, as it was locally called, was the principal thing used in beating out the corn, so simple in its construction that it had not undergone any change or improvement since the days of our Saxon forefathers; and then, again, the winnowing, which was principally done by women heaving it up against the natural current of air, subject to all the annoyances of calm, rain, and change of wind. I have heard that when the winnowing machines were first introduced, some objected to them as subverting the laws of nature by making artificial wind. Horse thrashing machines were certainly in use at the commencement of the century; but then they were few, and only on large farms. Cobbett speaks of the beautiful music of two flails and a cuckoo. Of course this had an under meaning: that the farmer who could keep corn till spring or summer, was supposed to be in easy circumstances. Now, when we consider the change from the flail and sieve and keiser to the ponderous steam machines that are now moving from farm to farm, and preparing for market its 100 or 200 Cornish bushels a-day, it is almost past our comprehension, and especially when we think that there had been no improvement in that branch of farming for, perhaps, a thousand years before.

" The next thing I would call your attention to is to keep and *breed of stock*. It is true, strictly speaking, this is not agriculture; but in common acceptation, it comes under the same meaning, and, I suppose, in a paper of this kind would be expected to be treated of. Sixty years ago very little attention was paid to what is now thought and talked of so much—I mean the breed or blood of stock. First, we will take bullocks. The old Cornish or primitive cattle were then general; the only admixture at all would be the North Devons. It is true that this useful breed had, at the time we refer to, found its way into many parts of the county. Although, at the commencement of the century, there was very little attention paid to breeding, yet there were many fine bullocks reared and fed. The reason was this: oxen were much in use, and all the best or most promising steers were kept for that purpose. These were worked for a few years, and hence they were got to a maturity of growth before fattened; great numbers of steers and oxen were brought down for the eastern part of the county, and it was a source of pride and emulation among the old farmers who should turn out the best oxen. I remember oxen of a thousand weight of the old Cornish breed, but these were not general. Cattle, now-a-days, are brought to the market at a much earlier age, and I suppose we may put down, as a fair average, that they are 2 cwt. heavier when brought to the market than fifty years ago. In those days, there being little or no turnips, cattle had frequently a hard time of it to pass through the winter, and in summer, being turned away to commons or the coarsest pasture in low condition, young stock were frequently four or five years old before they came into profit. I must notice here the introduction of a new breed of cattle, the *Shorthorns*, or, as they were first called, the Durhams. These were first introduced into this county (as I suppose) by the late Mr. John Penhallow Peters, and I estimate the time about forty years since. The shorthorns have now spread themselves by mixture and otherwise over many parts of the county, and have many admirers, and in some instances are brought to great perfection; but whether they will stand the climate and many of the poor soils of Cornwall, time alone can show. More recently the *Hereford* stock has been introduced, but up to this time has not become very general.

" However great a change has taken place in the breed, keep, and management of bullocks, the same remarks will apply equally to *sheep*. A small hardy sheep, without any introduction of new blood, was all that was to be found in this county at the commencement of the century. The first impetus given to the improvement of this stock, was by the introduction of the Leicester, and, I suppose, like the shorthorned cattle, the honour belongs to Mr. J. P. Peters. Southdowns have also found their way into many parts, and recently the Shropshire, which is a larger and better shortwoolled sheep. But, however great the change has been in the breed, it is little compared to the improvement in keep and attention given to this stock. By the introduction of two or three new breeds, both in cattle and sheep, of course the crosses have been almost interminable. Many of those crosses have been successful, but it requires great caution in this matter. This is, however, foreign from our present subject. Pigs must now, for a moment, claim our attention; and I must say they have come in for a fair share of attention with agriculturists generally, and although they are discontented animals, especially without meat, they have no reason to be discontented on this ground.

" We can remember when the large white pig was the only one to be found, with immense ears hanging over its face, and if the elephants recently exhibited here were called 'umbrella elephants' in consequence of their large ears, I think, if the ladies would allow us, these pigs might claim the name of 'parasol pigs;' for their ears kept the sun out of their own eyes at any rate. The present breeds of pigs are too well known for me to trespass any further on your time. *Horses* were in many instances very good fifty years ago, and there is not the improvement in this as the other stocks we have named. Horses were worked less, and fared harder than at the present day. The horses then, although not generally so large as at present, were characterised for great endurance of fatigue, and were exceedingly sure-footed on the roads. Farm horses frequently, like bullocks, had to winter it as best they could, with no other covering than nature supplied them with; and this leads us on to consider the greater accommodation in farm buildings than formerly. Supply and demand have followed each other. Green crops brought more cattle, and more cattle brought more houses.

"*House accommodation* is now one of the first things a farmer has his eye to when taking a farm, and one of the first stipulations with his landlord. I remember once talking with a friend from America, who had been absent from this country over twenty years: he said nothing struck him so much, on his return to Cornwall, as the improvement in farm buildings. Within the last few years there has been a great stimulus given to the improvement of *waste land.* The causes which have led to this are, I consider, in the first place, the discovery of new manures; secondly, improved implements; and lastly, the long continued high price of farm produce, consequent, under the blessing of Providence, on a state of national prosperity, caused, no doubt, by a long peace, and the resources of the nation being turned to agriculture, manufactures, and commerce, instead of the destructive art of war; and we must also admit that we are not a little indebted to the wise and liberal acts of the Legislature. A great deal of waste land was brought under cultivation before the close of the last French war, which, after the peace, in many instances was again left to run to a state of nature, owing to the depression which fell on the nation after such a long war. But I think it may be safely anticipated that those who enter upon such speculations now, have far safer data to go upon, and they deserve the encouragement and good wishes of the community at large. We might give one word to what is called *thorough draining.* Although wet parts of fields and cutting out of springs had been frequently attended to, yet such a thing was never known as to drain land systematically. Here, again, we are in a great measure indebted to the inventor of the drainpipe machine, as, without pipes, stone could never be got in sufficient quantities for such purpose. Perhaps few things have undergone a greater change in agriculture during the last fifty or sixty years than labour. *I estimate that labour in that time has been economised near fifty per cent.* This is principally owing to machinery, though other causes have operated also. During the same period the price of labour *has risen thirty-five per cent.;* and it costs a great deal more in implements and machinery than formerly. The changes in our natural lives are scarcely distinguishable from year to year. As when on a journey our advancement is not sudden, yet, when we sometimes take a stand and look back, we find that we have progressed a long way, so in the subject we have now under notice, we may not have seen great changes from one year to another, yet, in looking back half-a-century, we see a vast difference in that time. There is one thing we should ever bear in mind—that the efforts and inventions of man are puny indeed without the blessing of a gracious Providence; and, although some seasons have been more propitious than others, yet the sunshine and the shower have been given—summer and winter, seed time and harvest, have not failed."

III.—*The Depreciation of Gold*, 1847-69.

THE following communication from Professor W. Stanley Jevons, appeared in the *Economist* on the 8th May last:—

"It is interesting to examine at intervals the evidence brought by the efflux of time concerning the effects of the great gold discoveries of 1849 and 1851 upon the value of gold. Almost twenty years have now elapsed since the new supplies began to be received, and taking into account the rapid means of communication with all parts of the world which this age enjoys, it can hardly be doubted that a certain equilibrium has been attained in the distribution of the precious metals, and that the character of the results will now be manifest.

"The present year is especially suitable for a retrospective inquiry, because we have just passed through nearly three years of commercial prostration, during which the use of credit has been undoubtedly reduced to its minimum, and prices have suffered a corresponding depression. Taken in connection with the similar depression which followed the collapse of 1857, this gives us ample means of judging whether a real rise of prices has been established, because it assures us that any rise of prices which may be detected is not due to a temporary cause, such as the inflation of prices by credit.

" I have therefore made some calculations founded upon your price lists, in order to bring down to the present time the estimates of the general variation of prices which I first attempted in my pamphlet on the Value of Gold, and afterwards extended over the whole period embraced in Mr. Tooke's *History of Prices*, the complete results being published in the *Journal* of the London Statistical Society for June, 1865. The inquiry is substantially of the same nature as that which was originated by Mr. Newmarch in the *Statistical Journal* for 1859, and which has since been continued in your invaluable Annual Review. Your readers will probably have noticed on p. 44 of the *Commercial History and Review of* 1868, a table containing the proportionate prices of a number of commodities compared with their average range in 1845-50, and a column is added containing what you have called the total index number, formed by the simple addition of the percentage numbers of the separate commodities. My method is very similar, but consists in calculating, in a manner fully described in the *Statistical Journal*, the average ratio of prices in March of each year to prices in the same part of the previous year, so that by the junction of these ratios the prices of each year can be compared with those of any year before or after, just as in taking the levels of a line of country the difference of level of each two successive points is measured, and then the difference of any two points on the route can be ascertained by the simple junction of the intervening differences. Any year may readily be made the *datum line* or point of comparison, but the year 1849 is peculiarly fitted to be the starting point, because it was not only the first year of the gold discoveries, but it also happens that prices then reached the lowest point which they have attained during the present century.

" The following numbers thus deduced show the average ratios of the prices of about fifty of the chief articles of commerce during the last twenty-two years to the prices of the same articles in 1849:—

Year.	Average Ratio of Prices to those of 1849.
1847	122
'48	106
'49	100
'50	101
'51	103
'52	101
'53	116
'54	130
'55	125
'56	129
'57	132
'58	118
1859	120
'60	124
'61	123
'62	124
'63	123
'64	122
'65	121
'66	128
'67	118
'68	120
'69	119

" It appears from the above that the range of prices has since 1853 been always considerably above the point they attained in 1849. The three great collapses of credit and enterprise occurred in the years 1847, 1857, and 1866, and the depressions of prices thereby occasioned were respectively 22, 14, and 10 per cent.; it is perfectly fair therefore to compare together the three lowest points thus attained in the years 1849, 1858, and 1867, and we thus learn that there has been a *net* or permanent rise of 18 per cent. accomplished in the prices of about fifty of the chief materials and commodities. The still greater elevations of 32 per cent. in 1857 and 28 per cent. in 1866 are partly due to the inflated credit and excessive speculation of those periods. It may seem that my numbers under-estimate rather than over-estimate the fluctuations of prices; but it must be remembered that though many commodities in which speculation chiefly takes place vary much more than is shown in the average, there are many articles—such as butcher's meat and provisions —which are little subject to speculative changes, and in drawing a wide average many considerable changes in individual commodities are entirely obliterated.

" The results given above will be found to correspond pretty closely with the like results which are easily drawn from the index numbers in your Annual Review, except that from 1863 to 1867 you represent prices as having risen much more than I state them. This I find is due to your index number being the sum of twenty-two different numbers, of which four numbers represent the increased prices of raw or manufactured cotton; as these prices have risen in one case as much as by 360 per cent., a great effect is produced on the aggregate. My quotations include only three out of fifty depending on cotton; besides which my mode of drawing a geometrical average always gives a less result than the simple addition employed in the Annual Review. It may be a matter of opinion which result is the truer one, but at any rate I am satisfied to feel that I under-estimate the fluctuations of prices as compared with the results in your Annual Review.

" I cannot help then reasserting with the utmost confidence that a real rise of prices, to the extent of 18 per cent., as measured by fifty chief commodities, has been established since the year 1849. This is an undoubted depreciation of gold, because it represents a real diminution in the general purchasing power of gold. Nor can we well avoid attributing it to the effect of the gold discoveries. Indeed, as Professor Cairnes has so distinctly pointed out, the effect of those discoveries is probably much greater than any we can prove, because the course of prices was in previous years decidedly downwards, so that the new gold has both prevented a further fall and occasioned a rise in its stead. To illustrate this, I have formed from the tables given in my paper in the *Statistical Journal* (founded upon Mr. Tooke's tables of prices) the following comparison of prices at intervals of ten years, taking the year 1849 as the datum point:—

Year.	Average Ratio of Prices to Prices of the Year 1849.
1789	133
'99	202
1809	245
'19	175
'29	124
'39	144
'49	100
'59	120
'69	119

" Between 1809 and 1849 we notice a vast decline of prices, to the extent of 145 per cent., the previous rise having been nearly as great. With this great revolution in the value of gold, we are only concerned so far as regards the fact that previous to 1849 a great decline in prices was in progress. This decline was interrupted during the years 1835-39 by a temporary rise, due perhaps to excessive speculation, but the decline was renewed as rapidly as before until we reach the critical year 1849. Since then the course of prices seems to have been entirely altered, and a permanent rise has been established.

" Not a few able writers, including Professor T. C. Leslie, who lately addressed you on the subject, are accustomed to throw doubt upon all such conclusions, by remarking that until we have allowed for all the particular causes which may have elevated or depressed the price of each commodity we cannot be sure that gold is affected. Were a complete explanation of each fluctuation then necessary, not only would all inquiry into this subject be hopeless, but the whole of the statistical and social sciences, so far as they depend upon numerical facts, would have to be abandoned. It has been abundantly shown by M. Quetelet and others, that many subjects of this nature are so hopelessly intricate, that we can only attack them by the use of averages, and by trusting to probabilities. The price of any one commodity, even silver, utterly fails as a measure of the value of gold, because it is sure to be affected by numerous conflicting causes of rise and fall, no one of which we can accurately estimate. Even the intimate knowledge which a merchant gains of the commodity in which he deals is insufficient to enable him to explain, still less to predict, the changes in its price with confidence. But when we take a large list of fifty commodities the probability is almost infinite that particular influences will not all act the same way, so that a rise in one case will balance a fall in another. The average then must in all reasonable probability represent some single influence acting on all the commodities. This influence may indeed be something affecting the commodities rather than gold—for instance, a general increase of demand not met by a corresponding supply. This is possible but not likely, because the supply of many articles is exceedingly increased and cheapened by the progress of civilisation. Even if it were the commodities which were altered in their conditions of supply and demand, the result would not the less be an alteration in the purchasing power or value of gold. But considering that there is no reason to suppose the supply and demand for gold would always maintain an equilibrium, and that a most extraordinary change has taken place in the conditions of supply, the probability is excessively great that we find the true cause in the gold discoveries.

" To complete the argument, I have only to ask those who think that the growth of population, the increase of demand, or the progress of trade is the cause of the rise of prices, whether population, demand, trade, &c., were not expanding before 1849, not so rapidly perhaps as since, but still expanding; and how it is that causes of the same kind have produced falling prices before 1849 and rising prices since?

" To gain some notion of the degree of probability of conclusions on this subject, it has occurred to me to apply the ordinary methods of the theory of probabilities to the results stated in my pamphlet on the value of gold. The list of commodities there given (including cotton) contained thirty-six different articles, of which twenty-nine were found to have risen in price in 1862, as compared with the average of the years 1845-50, while only seven had fallen in price. All the alterations of price (excluding the extreme rise in the case of cotton) lay between a fall of 26 per cent. and a rise of 67 per cent., but most of the alterations were about 10 or 20 per cent. Regarding each of these thirty-six commodities as a separate and independent measure of the alteration in the value of gold, I first took the average rise of prices, namely, 16 per cent., as the most probable estimate which these thirty-six measures give, and then proceeded to calculate by the ordinary method of least squares the probable error of this result. This probable error proved to be just 2½ per cent.—that is to say, *it is as likely as not that the true alteration of gold lies within 2½ per cent. of 16 per cent.,* or between

13½ and 18½ per cent. From this result we can readily calculate the probability that gold is depreciated *in some degree*, or that the true result if it be not 16 per cent. rise is above 0 per cent. rise. This probability proves to be so near to certainty that the tables required in the calculation do not go sufficiently far to enable me to give it exactly. It may be safely said that the odds are 10,000 to 1 in favour of a real depreciation of gold. The meaning of this is that the chances are 10,000 to 1 against a series of disconnected and casual circumstances having caused the rise of price—one in the case of one commodity, another in the case of another—instead of some general cause acting over them all. It is true that as the commodities do not all vary independently, different kinds of corn, for instance, generally recovering together, the improbability is not so great as stated; but if we reduce it ten times, to 1,000 to 1, it is great enough for my purposes.

"Taking into account the separate probability that such a result would follow from the gold discoveries, I believe it is wholly beyond doubt that the expected result has been manifested, but not in the mode predicted. Many eminent men, especially M. Chevalier, looked upon the depreciation of gold as a sudden and revolutionary event which would happen in the course of time, and yet I believe that when M. Chevalier was writing the most sudden and serious part of the effect had already been produced. Prices have never since stood so high as they did in 1854 and 1857, and though returning enterprise and expansion of credit will doubtless occasion another rise in the next few years there seems to be no reason to suppose that we shall get beyond the point attained in 1857. I should therefore not venture to call in question the remark of your annual reviewer, that the tendency is now in an opposite direction—in that of appreciation rather than depreciation. It is quite possible that the causes which occasioned a great fall of prices before 1849 are now again beginning to make themselves felt. All I contend for is the existence of some disturbance which in the last twenty years has prevented the previous fall of prices from continuing. The tables of your Annual Review unmistakeably prove the existence of a rise: to what must we attribute it? To the growth of population and trade? I think that the growth of population and trade tend to lower prices by increasing the use of gold, and to this cause we may reasonably attribute the fall of prices before 1849. But to attribute to the same cause, as some do, the diametrically opposite change which has occurred since 1849, is illogical in the extreme. The normal course of prices in the present progressive state of things is, I think, downwards; but for twenty years at least this normal course has been checked or even reversed, and why should we hesitate to attribute this abnormal effect to the contemporary and extraordinary discoveries of gold?

"It would not be difficult to show that not only have prices risen during the period in question, but that the relations of society have readjusted themselves in accordance. While statisticians have been disputing, society has practically accepted the fact of a rise. The pay of the army is increased, the whole of the civil service and the staff of the Bank of England receive larger salaries, and could the information be obtained, I believe the same change might be shown to have occurred in most private establishments. Trades' unionists point to the services rendered by their societies in gaining a rise of wages. Financial reformers, on the other hand, point to the great increase in the public expenditure of the kingdom as a proof of extravagance. To all these effects the alteration in the value of gold has, I believe, contributed something; it would not be too much to say, that the increased cost of materials and wages has added three or even five millions to the public expenditure, and wages not unnaturally rose when gold was perceptibly depreciated."

IV.—*New Zealand Census, December,* 1867.

FROM the *Australian Mail*, 13th July last:—

" We have received, somewhat late indeed, the final results of the Census of the colony of New Zealand, taken in December, 1867. The principal tables have already been published, but it will be interesting to take a survey of the progress of the colony as a whole. The *triennial* census enumeration was taken for the night of the 19th December, 1867, on a plan substantially the same as that adopted in December, 1861, and December, 1864, by which the information was obtained not only for each province of the colony, but also for each of the electoral districts returning members to the General Assembly.

" The population of New Zealand (exclusive of aboriginal natives and of the military and their families), was, as shown by the census returns for December, 1867, 218,668, of whom 131,929 were males and 86,739 females. The distribution of this population through the several provinces was as follows :—

	Males.	Females.	Total.
Auckland	27,063	21,258	48,321
Taranaki	2,528	1,821	4,359
Wellington	12,401	9,549	21,950
Hawke's Bay	3,197	2,086	5,283
Nelson	16,425	7,389	23,814
Marlborough	2,736	1,635	4,378
Canterbury	33,083	20,783	53,866
Otago	29,773	18,804	48,577
Southland	4,600	3,343	7,943
Chatham Islands	123	61	184
	131,929	86,739	218,668

" It will be seen that the *Northern Island* (comprising the provinces of Auckland, Taranaki, Wellington, and Hawke's Bay), contained 79,912, or 36·58 per cent.; and the *Middle Island* (comprising the provinces of Nelson, Marlborough, Canterbury, Otago, and Southland), 138,571, or 63·42 per cent. of the whole population of the colony. There can be no doubt, however, that the actual numbers exceeded the totals given for the colony, as, besides individual omissions through the negligence of sub-enumerators or from other causes, there are almost insuperable difficulties in obtaining a correct enumeration of the gold-digging population. Had such an enumeration been practicable, the total would almost certainly have been many hundreds or even several thousands more than it is.

" The ascertained numbers in 1867, as compared with the population shown by the census of 1864, exhibit *an increase* within the triennial period of 46,510, or 27·01 per cent. The *average annual increase* from 1864 to 1867 thus appears to have been 9 per cent. The following summary shows the numerical increase or decrease in each of the provinces within that period, with the proportionate increase or decrease in 1867, calculated on the population of each province in 1864 :—

Towns, &c., 1867 *as Compared with* 1864.

Towns, &c.	1867. Increase.		1867. Decrease.	
	No.	Per cnt.		
Auckland	6,189	14·7	—	—
Taranaki	—	—	15	·3
Wellington	6,963	46·5	—	—
Hawke's Bay	1,513	40·1	—	—
Nelson	11,904	99·9	—	—
Marlborough	—	—	1,148	20·8
Canterbury	21,590	66·9	—	—
Otago	—	—	442	·9
Southland	—	—	142	1·8

"A comparative table shows the population for the respective *Provinces* in 1858, 1861, 1864, and 1867:—

	1858.	1861.	1864.	1867.
Auckland	18,177	24,420	42,132	48,321
Taranaki	1,236	875	1,502	1,831
Wellington	11,753	12,566	14,987	21,950
Hawke's Bay	1,514	2,611	3,773	5,283
Nelson	9,272	9,952	11,910	23,814
Marlborough	—	2,299	5,519	4,371
Canterbury	8,967	16,040	32,276	53,866
Otago	6,995	27,163	49,019	48,577
Southland	—	1,876	8,085	7,943
Chatham Islands	85	50	86	184
Totals	59,413	99,021	172,158	218,668

"In 1851 the *total population* numbered 26,707. In 1858 it had increased to 59,413, being an *increase* in seven years amounting to 32,706 persons, or 122·46 per cent. In 1861 the total was 99,021, being an *increase*, as compared with 1858, of 39,608, or 39·99 per cent. In 1864 the total was 172,158, being an *increase*, as compared with 1861, of 73,137, or 73·86 per cent. And in 1867, as has been shown, the total was 218,668, being an increase, as compared with 1864, of 46,510 persons, or 27·01 per cent. Comparing the two years, 1851 and 1867, the aggregate increase during the period of sixteen years amounted to 191,961 persons, or 718·77 per cent., being an average increase for each year included in the period amounting to 11,997 persons, or 44·92 per cent.

"A separate table is devoted to the population of cities and towns in the colony:—

	1864.	1867.
Auckland	12,424	11,153
New Plymouth	2,944	2,180
Wellington	4,711	7,460
Napier	1,377	1,827
Nelson	4,701	5,652
Picton	889	506
Christchurch	6,438	6,647
Lyttelton	2,789	2,510
Dunedin	15,790	12,777
Invercargill	2,242	2,006
Parnell	—	3,226
Newton	—	3,227
Onehunga	—	2,177
Wanganui	—	2,157
Westport	—	1,500*
Charleston	—	1,800*
Brighton	—	1,000*
Addison's Flat	—	1,500*
Hokitika	—	4,866
Greymouth	—	1,607
Rangiorá	—	1,042
Timaru	—	1,027
Port Chalmers	—	1,347
Oamaru	—	1,377

* Estimated.

"An appendix relates chiefly to the *Northern Island*, in which the bulk of the *Maori* population is found, including, however, those in the province of Nelson and the prisoners who were then at the Chatham Islands. This does not profess to be any more than an estimate, and remarks appended to some of the figures point to the conclusion that estimate is below what are (or at least then were) the true numbers. Taking the figures as they stand, they show 14,897 men, 12,353 women, and 9,857 children, making a total of 37,107. These, added to the number in the Southern Island, represent the general (estimated) total of the aboriginal native population in the colony as 38,540.

"The *average proportions of the sexes* in December, 1864, was—males, 61·91; females, 38·09; excess of males 23·82. In December, 1861, they were—males, 61·67; females, 38·33; excess of males, 23·34. This was a remarkable increase on the proportion of males as compared with 1858, when the proportions were—males, 56·68; females, 43·32; excess of males, 13·36 per cent.; but it was to a considerable extent explained by the great influx of miners to the gold fields of the colony, very many of whom were unmarried or had left their wives and families in other countries. It is gratifying to observe that, notwithstanding the continuance of this element of disparity, yet the last returns show some tendency towards an equalisation of the numbers of the sexes.

"The general totals for the colony, as shown by the census of 1867, were as follow:—*Married males*, 34,291, being 15·68 per cent. on the whole population and 25·99 per cent. on the total number of males. *Married females*, 32,606; being 14·91 per cent. on the whole population and 37·59 per cent. on the total number of females. *Unmarried males* (including widowers and male children), 95,562; being 43·70 per cent. on the whole population and 72·43 per cent. on the total number of males. *Unmarried females* (including widows and female children), 53,177; being 24·31 per cent. on the whole population and 61·30 per cent. on the total number of females. The number of widowers and widows is, 2,380 widowers and 2,562 widows There were 3,032 persons (viz., 2,076 males and 956 females) with regard to whom no information as to condition was obtained. If we deduct from the totals of 'unmarried' the persons under 15 years of age, the numbers remaining are—males, 55,217; females, 14,337. The proportions between the sexes from the age of 15 upwards is thus shown to be 79·39 per cent. of males and 20·61 per cent. of females. The information thus arrived at may be expressed otherwise, as follows:—Of every 100 of the total male population, 25·99 per cent. were married; and 41·86 aged 15 and upwards, with 30·58 under 15, were unmarried (there being 1·57 whose 'condition' was not stated); and of every 100 of the total female population, 37·60 per cent. were married; and 16·53 aged 15 and upwards, with 44·17 under 15, were unmarried (there being 1·10 whose 'condition' was not stated). According to the census of 1864, a similar calculation exhibited the following results. Of every 100 of the total male population, 25·78 per cent. were married; and 44·95 aged 15 and upwards, with 27·97 under 15, were unmarried (there being 1·50 whose 'condition' was not stated), and of every 100 of the total female population 38·50 were married; and 17·43 aged 15 and upwards, with 43·55 under 15, were unmarried (there being 0·52 whose 'condition' was not stated).

"The total number of *houses or dwellings* in the colony in December, 1867, was 54,015, against 37,996 in 1864, being an increase of 16,019 within the three years. It is to be remarked, however, that the gross total for 1867 included 4,595 tents, against 6,742 in 1864, most of these in both years being, as might be supposed, in the gold fields districts. The tents may be regarded as included in the numbers of dwellings having 'one or two rooms,' which in 1867 amounted to a total of 26,558, against 18,841 in 1864; there being in 1867, as compared with 1864, 6,209 dwellings of three rooms, against 4,612; 7,844 of four rooms, against 5,352; 3,543 of five rooms, against 2,451; and 9,861 of six rooms and upwards, against 6,674 in 1864. With respect to the materials of which the houses were constructed, the returns show—wood, 31,844, against 25,463 in 1864; stone or brick, 1,182, against 1,082 in 1864; and other materials (including raupo houses and the tents above referred to), 13,989, against 11,451 in 1864.

"The *total male population* shown in the tables for the electoral districts (which, it is to be borne in mind, do not include the numbers who were on shipboard on the census night, or the inhabitants of the Chatham Islands), is 129,761; of whom 80,122 were aged 21 years or upwards. The *total number of electors* on the rolls at the same date was 33,338, a number which does not include the electors for the electoral district of the Otago gold fields, the nature of whose qualification (as defined in 'The Miners' Representation Act Amendment Act, 1863') does not admit of the formation of an electoral roll in the usual way. The *total number of representatives* for these constituencies in the General Assembly was seventy-two (including the two members for the Otago gold fields, but, of course, not including the members for the four Maori electoral districts constituted by 'The Maori Representation Act, 1867,' by which the House of Representatives has been made to consist of seventy-six members altogether). The proportion of electors to every 100 of the total male population shown for the electoral districts, in December, 1867, was 25·69 per cent., against 19·71 per cent. in 1864 and 22·39 per cent. in 1861, and the proportion to every 100 males aged 21 and upwards was, in 1867, 41·60 per cent., against 31·43 in 1864 and 39·32 in 1861. Table X contains calculations of the proportions for each electoral district; but although these calculations exhibit correct results as the electoral rolls actually stood at the time, the value of the detailed comparison between electoral franchise and population is necessarily qualified by the consideration that in numerous instances the electors are non-resident, many having votes in more than one district.

"The *places of birth* of the population are shown for the several provinces in two tables of some interest. The following were the proportions for the whole colony:—England, 30·01 per cent.; Ireland, 12·78; Scotland, 15·93; Wales, 0·60; New Zealand, 29·29; Australian colonies, 5·17; other British dominions, 1·74; United States of America, 0·56; France, 0·25; Germany, 1·30; China, 0·56; other foreign countries, 1·12; at sea, 0·34; not specified, 0·35."

V.—*Medical Students.*

AN Address delivered at St. Bartholomew's Hospital, by James Paget, F.R.S.:—

It is said that, on entering the anatomical theatre for one of his introductory lectures, Mr. Abernethy looked round at the crowd of pupils and exclaimed, as if with painful doubt, "God help you all! what will become of you?"

I am not aware that any attempt has hitherto been made to answer such a question. The grounds on which I venture an answer are, in the knowledge of what became of a thousand of my pupils within fifteen years of their entrance at St. Bartholomew's Hospital. The number may suffice for the grounds of that degree of general belief which, in a matter of this kind, is as near an approach to knowledge as we are likely to attain. And I believe that what may be told of the pupils of St. Bartholomew's, would hold true of those of all the metropolitan schools; for with us the varieties of students, according to differences of birth, wealth, and previous education, are collected, I believe, in very nearly the same proportions as would be found in all the other metropolitan schools together.

The pupils from whose careers the following notes are derived, were among those who attended, either my demonstrations of morbid anatomy between 1839 and 1843, or my lectures on general and morbid anatomy and physiology between 1843 and 1859. Of the former, I kept no complete lists, but have the names of ninety-five; of the latter, I have complete lists, containing 1,131 names. Of the total, 1,226, many have been quite lost sight of.* The careers of 1,000 are known either to myself or to Mr. Callender or Mr. Smith, or all of us; for we have worked together for this essay.

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* Since writing the paper I have heard of a few more; but I have not used them for the tables. They would not disturb the proportions, which are more

Of the thousand—

23	achieved distinguished success.
66*	„ considerable „
507†	„ fair „
124	„ very limited „
56	failed entirely.
96	left the profession.
87	died within twelve years of commencing practice.
41	„ during pupilage.

In this table, they are classed as having achieved distinguished success who, within fifteen years‡ after entering, gained, and to the end of the time maintained, leading practices in counties or very large towns, or held important public offices, or became medical officers of large hospitals, or teachers in great schools, as the professors of anatomy in Oxford, Cambridge, and Edinburgh, all of whom it was my singular good fortune to have for pupils.

Considerable success is ascribed to those who gained and still hold high positions in the public services, or leading practices in good districts, or who retired with money earned in practice, or gained much more than ordinary esteem and influence in society.

The fair or moderate success which was the lot of rather more than half of those whose histories are known, means that measure of well-doing which consisted in having a fair practice—enough to live with—maintaining a good professional and personal reputation, or in holding ordinary appointments in the public services, or in the colonies, and gaining promotion in due course of time.

Very limited success is assigned to those who, within the fifteen years, were not even in moderately good practice, or apparently likely to attain it; or who were just living, and that not well by their work; or still employed as assistants in ordinary practices; or erratic and never prosperous; or doing much less than, with their education and other opportunities of success, they should have achieved.

They who failed entirely were a very mixed class, agreeing only in their total want of success. Of the fifty-six who made up the gloomy total, fifteen were never able to pass examinations—some because of idleness or listlessness, a very few through sheer want of intellect. Of those who did pass, five failed because of scandalous misconduct; ten through ill-health, or misadventure, sheer ill-luck as it seemed; and ten through their continuance in the same habits of intemperance or dissipation as had made us, even while they were students, anticipate their failure. Of the remaining sixteen we only know that they have failed; they are not in disrepute, but they are barely maintaining themselves.

It will seem strange to every one, I think, that so many as ninety-six, that is nearly 10 per cent. of the whole number, left the profession after beginning either its study or its practice; and it is even less flattering to our calling that, to set over against those who left us, there were only seven who came to us from other studies or pursuits in life, and five of these again changed their minds and never engaged in practice.

Of these ninety-six, thirteen while pupils left or were expelled in disgrace, and three were wisely removed by their friends. Of the remaining eighty, one while

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easily calculated in the exact thousand, than in a rather larger number. If it were possible to learn what has become of all those whom we have lost sight of, they would probably be classed in due proportions under all the headings in the table except the first two.

* Including three dentists.

† Including seven dentists.

‡ Or less, in the cases of those entering between 1854 and 1859.

still a pupil, and one after beginning practice, retired on private means, too rich to need to work; four, after beginning practice, had to leave in disgrace—one of these was rather sinned against than sinning; another, who had been a good student, speculated in mines, lost money, forged, and is in prison; three became actors, of whom two are in obscurity, and one is well esteemed in genteel comedy; four entered the army with commissions, one after and three before obtaining a diploma for practice; three pupils enlisted as privates, and one of these distinguished himself by courage and good conduct sufficiently to win a commission; one, while a pupil, left for the bar, and has succeeded; five, after passing, took orders in the Church of England, two in the Church of Rome; ten pupils, and as many after having begun practice, left for different forms of mercantile life at home or in the colonies; three pupils and six young practitioners took to farming. The remaining twenty-seven left the profession for various pursuits, which need not be specified, unless to say that three became homœopathic practitioners, but took to that class no repute for either wisdom or working power.

On the whole, looking over the list, and remembering the characters of those who left the profession for other pursuits, there appears no reason for believing that they have "bettered" themselves. Some have succeeded, some have failed; the result would have been, I think, the same if they had remained in their first calling.

Last comes the melancholy list of deaths, telling that of those who entered nearly 13 per cent. were dead within fifteen years.* Of these forty-one died while yet pupils, including seventeen who died of phthisis, four (at least) of fever caught in the hospital, and two who committed suicide; eighty-seven died after beginning practice, some after attaining great success, some after long and vainly struggling in ill-health; twenty-one died of diseases incurred in their duties; five committed suicide, two of them under circumstances of great disgrace; one was hung, the notorious Palmer, who committed murder at Rugeley—he was an idle, dissipated student, cursed with more money than he had either the wisdom or the virtue to use well.

This, then, is what became of a thousand medical students; and, probably, the same lots in life, or nearly the same, have fallen or will fall to as many thousands more. It would be interesting if, with facts such as these, one could compare our profession with others, as to the chances and degrees of success that it offers to its students. But I know no facts that would serve for a comparison; nor would any be fair unless account were taken of the several amounts of capital in time or money expended upon each pursuit, and the times of reaching and the securities of retaining success in each, and their various social advantages and happinesses. On all these points we are without knowledge.

There might seem more hope of being able to tell the influence of different modes of education on the afterlife of medical students; and thence of deducing some scheme that should greatly increase the successes and decrease the failures. But to do this with accuracy would require many more facts than any one is likely to obtain. Of course, in watching and reflecting on the careers of my pupils, I have come to some strong beliefs on subjects of medical education; but this is not the place for publishing them. Only one I will set down, which may be of use to future pupils, and is justified by some hundreds of personal recollections. In remembering those with whom I was year after year associated, and whom it was my duty to study, nothing appears more certain than that the personal character, the very nature, the will, of each student had far greater force in determining his career than any helps or hindrances whatever. All my recollections would lead me to tell that every student may draw from his daily life a very likely forecast of his life in practice; for it will depend on himself a hundredfold more than on circumstances. The time and the place, the work to be done, and its responsibilities, will change; but the man will be the same, except in so far as he may change himself.

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* The number agrees so nearly with the general average mortality that it gives no reason for considering the medical profession either less or more healthy than other pursuits, at least in its earlier stages. For according to the "English Life Table, No. 3," out of any 1,000 males who have attained the age of 19 years, 131 will die within fifteen years.

VI.—*Movement for International Economy of Military Expenditure.*

An address delivered to the International Statistical Congress at the Hague, in September, 1869, by Edwin Chadwick, Esq., C.B.:—

Looking at the total of our respective budgets, for the maintenance of upwards of three millions of men kept under arms, in unproductive and commonly in demoralizing conditions in camps and cantonments, at an estimated collective expenditure of 280,000,000*l.* sterling annually in Europe, I venture to ask whether there is any topic on which the statists and economists of Europe can more usefully direct attention and researches in their several States, than as to the incidents of this vast burthen and the means of economising it. England may do this most befittingly because her declared policy, her position, and her interests, as regards other States of Europe, are no longer offensive but simply defensive. Indeed, it will be admitted on impartial consideration, that her present army, considering the extent of her dominions and her colonies, may be regarded as in great measure a police force for internal security. The British army for all India is not much more numerous than that of France for Algeria alone. For defence, with our great volunteer force, we are secure. Our economical interests, our mutual economical interests, are, however, in the augmentation of the productive power, that is to say, in the augmentation of the purchasing power of our neighbours. But indirectly we pay commercially, more or less, towards our neighbours' armaments, independently of the heavy amount we are made to pay by the augmentation of our own military expenditure, in rivalry of large adjacent offensive forces. If France could be led to reduce her military expenditure, and to devote the capital saved thereby to the real and complete conquest of the soil of France; that is to say, if by drainage and other works so much needed, she were to bring up her production, say of wheat, which averages 15 bushels an acre, to that of England, which is now upwards of 36 bushels, we of England should gain by it; our exports to France and our imports from France would be augmented by it, and it may be submitted to opinion there, that her real military power, which is now dependent on financial power, would not be reduced by it. But it is futile to occupy ourselves with preaching the utopia of universal peace, or proceeding on the basis of the reduction, even the notion, of the mutual of our military efficiency. In England we base our proposals of the economical reform of our military expenditure on the maintenance or the augmentation of military efficiency. Opinion is not yet, I believe, advanced beyond that. Now, I present an example of one topic for examination and consideration on that basis. In a branch of administration, with which I was connected some twenty-five years ago, I advocated the introduction of military and naval exercises in a number of the primary schools of destitute orphan children, maintained at the public expense under our administration. And they were so trained under my principle of the half-school time system. At the period of the last Congress in England I endeavoured to call international attention to the experience obtained in those institutions, one military point of which was that we could impart a complete military and also a naval drill, to upwards of one hundred and thirty boys well, at an expense of keeping and drilling one adult comparatively ill, and we find that when these drilled boys enlist, they are commonly accepted by the non-commissioned officers as having been in the ranks before. Whatsoever differences we may have with military men on army reform questions, we have hardly any on this. We have the highest military authorities with us on this measure as a means, amongst others, of promoting a more extended and higher order of voluntary recruitment. Besides good military qualities, the military exercises in the school stages have been found to impart qualities of so high an order for civil work, as to make the general adoption of the exercises worth while as a pure matter of civil economy. The evidence I collected on this topic was promulgated in some parts of Canada and in the United States, and has led to the introduction of the practice there, and its extension to all the primary schools is now a pending question of educational administration. In some parts of Switzerland military exercises have long been made part of elementary school training. Under an enlightened educational administration in France it has recently been obtained that military exercises shall form part of the training in all the Lycées, the secondary schools comprising some 40,000 of children. Now may we not well obtain some statistics of those efforts in the several States, and of how much is yet to be done to extend the practice to all primary schools, to the whole of the rising generations? And may we not then advance to the great economic question, how far the full exercises practicable in the non-productive school stages may serve to reduce the large amount of time now occupied in the productive adult stages of life? Such observations as I have been enabled to collect in England warrant the expectation of a considerable reduction of the period of adult training for military service, more than half of that in use in Prussia, and the greatest proportion of that in use in France; and consequently a great reduction of military expenditure; and that, too, with an increase instead of a reduction of military efficiency—I say an increase of military efficiency, for it is to be observed, what military men used only in old systems, are with us slow to note that the new arms of precision require a higher order of education and intelligence to wield them most effectively. The officers of our training schools, and of the volunteer army, declare that the order of merit in shooting is very much as the order of intelligence of the shooters.

A further question appears to me to arise, for consideration and discussion, viz., whether as a stimulus to serious attention in the schools, exemptions, or reductions of the periods of forced service may not be shot for? Prussia has, I understand, made a good advance in that direction, by allowing reductions and exemptions from forced service to be competed for on proof of attainments. In England, economical opinion, as elicited at late discussions at our Society of Arts in London, points at the substitution of a popular and numerous army, with a scientific cadre, on the basis of the Swiss army, for the less numerous but far more expensive standing army. Mr. Henry Cole showed that, on the basis of the Swiss army, and with a good scientific cadre, we could obtain a more popular army of a million of men for ten millions of money, than that standing army for which we now pay fifteen. We hope that popular opinion will support our present Prime Minister, Mr. Gladstone, in effecting in that direction important economies, which are needed in our financial condition. The progress of constitutional government in France, and on the continent, will, we may trust, favour the substitution of economical popular armies for large expensive standing armies. And in favour of this policy, and of basing military force on a higher order of education and intelligence, which will more readily adapt itself to the great changes which science is making in war, economists may observe, what old military men are very slow to acknowledge, that whilst the new arms of long range and precision, and penetrating power and rapidity, give one to offence, they give two and more to defence. We have recently had some decisive experimental proofs of that with artillery. Mr. Whitworth's smallest new gun, a 3-pounder, has a longer range than the heaviest of the old field guns in our service. Asking one of our old generals how it would have been had that gun been available for Waterloo, he answered that that battle could not have been fought with front lines within half the range of its shell, and with the necessity of keeping reserves at such distances to be out of its reach, that they could not be brought up over the open plain. A military writer of an important article in the *Journal des Economistes*, adduces military reasons to show that with the new arms of precision, an army of 100,000 men, trained to their use, might defend France effectually against invasion. Little Belgium is, by the new science made big, and may now do the like, and talk tall as to with whom she chooses to cast her lot. So little Holland is by the new arms of defence made great, and may keep herself to herself, or dispose of herself as she pleases.

In respect to offensive naval warfare, I may mention, that my friend Mr. Whitworth (who always does more than he says he will do), says he has now got a gun which, with a hundredweight of powder, will throw a shell of fifteen hundredweight more than five miles with superior accuracy, that will penetrate 12-inch armour plates. Little Holland, therefore, with one such gun in a small and quick moving boat, which is a relatively small mark, may keep at a respectable distance our large "Warrior," or the large and slower "La Gloire" of large France, or the small boat may send an enormous and fatal shell, which will penetrate the 6-inch armour plates of either. Other existing guns will indeed go through all existing armour plating. Science places the war administrations of large countries in the position of having incurred enormous useless expense for what is like a return to plate armour for the foot soldier, or for the cavalry soldier, as against the new small arm, the Whitworth rifle, which with a steel bolt will go through three men in armour — three of the heaviest armed cuirassiers. Indeed, for that matter, our military reporter on the small arms at the international exhibition admits, in effect, that he who now flourishes a sword, flourishes a folly for combat against a 6-shooting revolver. Science suppresses the old panoply of war, and makes fools of sabreurs. One other economical topic I will notice in the way of illustration. It is admitted that the future of war, since men will not readily be got to stand up to be mowed down as heretofore by these new guns, small and large, of long range and precision, will be very much a war of earth work and of engineering. Now it is proved by our Indian and other experience, that officers as well as privates are the better prepared for such warfare who are the most occupied in civil works in time of peace. Sweden, I believe, affords an important example of a large economy of military expenditure, by the extensive occupation of her army in civil work. Even France, to my knowledge, has recently afforded a brilliant example of the kind, by the occupation of a portion of her army in Algeria with the drainage and improvement of land for civil as well as for military occupation, has removed fever nests, and reduced the death-rate of her army there to one-fifth of what it was, and has set a good example for our use in India, as shown by an English military commission. Is it not then becoming of statists and economists, representatives of international opinion and interests, to collect, examine, and discuss, the statistics of such important economies? The Congress did enter somewhat into military questions, those chiefly of military hygiene in London, where our lamented colleague, Dr. Boudin, of France, presented very valuable information on the sanitary means of economising military force, now in very successful progress. I had the honour at the Congress of the Association for the Promotion of Social Science, to read a paper on the need of better care of the sanitary condition of our soldiers in India for the maintenance of our force there. This led to the appointment of the army sanitary commission for India, which has led to large reductions of the death-rates there, and to works of great importance for the benefit of the people of India. A special congress, on military hygiene chiefly, held at Geneva, was not without international fruit, as it led to an agreement to the mutual recognition of the destructive dress of medical officers, for their service in battle. Indeed the great Emperor of Russia—the liberator of the serfs—in whose domains we may hold our next Congress, has taken one step for an international agreement for the reduction of the horrors of war, by an agreement not to use shell with small arms, and thus avoid horrible and unnecessary mutilations. As it may be due that I should submit notices of definite topics for consideration, I beg respectfully to submit the following. The resolutions moved were that the Congress should move for the collection of statistics from the respective States, as to the extent to which military exercises had been introduced into schools and the results; as to the extent to which reductions of the time of military service, or exemption for them, had been allowed on competitions or proof of capacity; as to the extent to which the scientific cadres, or private soldiers, had been employed on civil work, or in private service.

The following gentlemen supported the views of Mr. Chadwick in the discussion following, viz., Mr. Ruggles, Mr. Vischers, Mr. W. T. Newmarch, Mr. Manwirth, Dr. Berg, Mr. Valpy, and Mr. Van Karnebeck.

VII.—*Matriculation and Honour Lists*, 1832-68.

THE following appears in *Macmillan's Magazine* for December, 1869:—

" Speaking roughly, not more than one man in three goes in for honours in any 'school' at the degree examination; and it is remarkable that, after considerable fluctuation, the proportion is nearly the same as it was thirty years ago, though in 1853 the new and, as it was thought, attractive subjects of natural science and modern history were added to the curriculum.

" As this point is controverted, it will be well to give the figures from which a conclusion is to be drawn.

" The number of classmen must be compared with the number of matriculations four years earlier, the examination taking place about four years after entrance:—

The Yearly Average of Matriculations in—		*Of Names in the Class Lists in—*	
1832–36 was	374	1836–40 was	131
'37–41 "	411	'41–45 "	121
'42–46 "	403	'46–50 "	117
'47–51 "	406	'51–55 "	149
'52–56 "	420	'56–60 "	147
'57–61 "	408	'61–65 "	130
'62–64 "	470	'66–68 "	161

" The numbers in the modern history school are steadily increasing; in the mathematical school, diminishing; in natural science, well nigh stationary; in 'literæ humaniores,' fluctuating. Of the total average of 161 from 1865 to 1868, 88 belong to literæ humaniores, 49 to modern history, 14 to mathematics, 10 to natural science. In the earlier lists, from 20 to 30 are in mathematics, the remainder in literæ humaniores.

" 'The midway examination, called Moderations, in which, on the classical side, nothing beyond the translation of a few Latin and Greek books and some indifferent composition, is required, attracts an increasing number of men. In 1855 101 gained classical honours; in 1861, 129; in 1868, 140. But the standard is that of schoolboy's work. Mathematical honours are also plentifully awarded.'—*Undergraduates' Journal, 25th October.*

" The *Undergraduates' Journal* is great upon the sermons; it puts them before the athletics, and in larger type. Not an insignificant phenomenon this, altogether."

VIII.——*The Tyne: Progress of Shipping Entries*, 1854-68.

" The River Tyne Improvement Commissioners have published some interesting statistics showing the increase of tonnage on that river since 1854, and it marks a remarkable transition in the carrying business of the country from vessels of a smaller to those of a larger class, as well as the development of the trade of the

Tyne in consequence of the great improvements made in that river by the river commissioners. The following is the statement showing the number of vessels clearing from the Tyne, the aggregate register tonnage thereof, and the average size of vessels for each year from 1854 to 1868 inclusive, as per returns of collectors of customs:—

Year.	Number of Vessels.	Tonnage.	Average Size of Vessels.
1854	19,096	2,849,680	149½
'55	18,152	2,791,371	154
'56	18,546	2,898,453	156½
'57	19,449	3,064,040	158
'58	19,190	3,001,800	156½
1859	18,823	3,060,145	163
'60	18,990	3,120,265	164½
'61	19,371	3,196,781	165
'62	19,336	3,171,145	164
'63	18,858	3,213,375	170½
1864	18,410	3,491,948	190
'65	19,663	4,037,422	205½
'66	19,416	4,171,538	214½
'67	18,949	4,221,852	222½
'68	18,910	4,076,084	215½

" The following Clearances Outwards for some other great ports of the country in 1868 (extracted from a parliamentary return issued this year), may be useful for comparison, viz.:—

Ports.	Vessels.	Tonnage.	Average Tonnage.
The Thames	15,748	3,881,578	246
" Wear	13,013	2,313,676	178
" Mersey	12,186	4,573,255	375
Cardiff	11,618	2,180,125	188
The Tyne	18,910	4,076,084	216

" A statement showing the clearances from the Tyne during eight years, of vessels above 500 tons, classified according to different sizes:—

	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.
Above 1,000 tons register	8	11	19	43	72	58	108	77
900 and under 1,000	6	7	16	14	22	29	35	28
800 " 900	92	92	110	85	89	83	102	114
700 " 800	16	20	36	95	81	123	143	147
600 " 700	48	62	58	79	94	122	109	130
500 " 600	76	102	183	659	1,153	1,284	1,256	1,105
	246	294	422	975	1,511	1,699	1,753	1,601

" During eighteen years, ending with 1868, the commissioners dredged no less than 29,724,221 tons of sand and mud out of the river, and have entirely removed the bar from the mouth of the Tyne."

IX.—*Management of Towns in the United States.*

THE following information is given by Dr. Jarvis, of Dorchester, Massachusetts, a valued honorary member of the Society:—

It is the policy of most of the States, especially those of the north, to leave as much of the local administration as possible to be determined by the people in their public assemblies. At these meetings they vote the taxes for schools, roads, poor, &c.

But even at these meetings of the whole people, no business can be legally transacted, unless it has been previously advertised and made known, under the authority of the select men, by warrants, such as these which I send, specifying each proposition to be brought before the meeting, and posted up in several public places in the town, or distributed to every family, a certain number of days previous to the meeting.

" The select men shall insert in the warrant all subjects which may in writing be requested of them by ten or more voters in the town."

By law of the United States, the election of electors of President is held on the first Tuesday in November every fourth year.

By law in this State, the governor, senators, and representatives are chosen on the same day in every year.

The annual meetings for choice of town officers, are held by law in this State in February, March, or April. Most towns hold this election on the first Monday in March.

In this town, all town officers are chosen at the March meeting. Money for all town purposes is raised at a meeting on the first Monday in April.

Besides these three regular town meetings in March, April, and November, there are special town meetings called for special purposes, whenever the select men think proper to call it, or whenever a certain number of voters request them to do so.

At all these meetings " every male citizen of 21 years of age and upwards (except paupers and persons under guardianship, and persons excluded by Articles 20 of the Amendment of the Constitution, requiring ability to read; and 23, requiring residence of foreigners within the United States, two years after naturalisation) who has resided within the State one year, and within the town, in which he claims to vote, six months next preceding a meeting for the transaction of town affairs; and who has paid by himself, or his parent, master, or guardian, a State or county tax, which has been assessed upon him, within two years next preceding such meeting in any town; and every citizen who is by law exempted from taxation, and in all other respects qualified as aforesaid, shall have a right to vote at such meetings upon all questions concerning town affairs."

The same conditions are required here " in the election of city, town, county, or State officers, or of representatives to Congress, and of electors of President and Vice-President " of the United States.

In every town the select men are required to prepare and post up in public places a list of all the voters in the town, and any one whose name is omitted, can go before the select men with his proofs of right to vote. If they find them sufficient, they must put his name on the list, and none can vote unless he is so inscribed.

In this town there are about 2,100 or 2,200 voters. But all do not vote—some are sick, some old, some absent from the town, some detained by business, some indifferent.

The presidential election being usually an occasion of great political interest, draws out the largest proportion of the voters. Last November, 1,680 voted in Dorchester—1,256 republicans for General Grant, and 424 democratic for Seymour. This is about 75 per cent. of all entitled to vote. At the election of town officers in March, less than 1,000 voted. At a later meeting called for a special purpose, for discussion and determination of a matter of interest, somewhat less than 800 were present. At the April meeting, to raise money for all town purposes, schools, roads, &c., less than 400 were present and voted 208,000 dollars.

In 1865, when our last census was taken, 19·4 per cent. of all the inhabitants of Massachusetts were voters, and 88·6 per cent. of the males over 21. The number over 21 not voters, 11·4 per cent., included foreigners not naturalised, paupers, &c.

The qualifications of voters are determined by each State for itself, and consequently they differ, but not widely. Some States admit every male over 21 present, however short his residence. Some States extend this privilege only to whites. The new article of the national constitution proposed by Congress, removes the objection of colour. This must be adopted by two-thirds of the State Legislatures before it becomes a law. Probably it will be accepted by the requisite number of States and more.

Female suffrage is attracting interest, and in some parts of the country a great interest. This sentiment is gaining, and not unlikely it will be accepted by some of our local Governments in course of a few years, and ultimately it may find favour in all.

X.—*Australasian Gold.*

From the *Times:*—

" The average number of gold miners employed in Victoria, in 1868, was 63,181, being a *decrease* of 2,676 upon the corresponding average for 1867. The *average earnings* of each man last year were 104*l.* 18*s.* 8*d.*, as compared with 87*l.* 1*s.* 7*d.* in 1867. There are 2,651 ascertained quartz reefs, and 886,228 tons of quartz were crushed in 1868. The average yield of gold was something over half-an-ounce to the ton, while the cost of crushing ranged from 2*s.* 6*d.* to 1*l.* 10*s.* per ton. The extent of auriferous land opened up by gold miners in Victoria is 882 square miles, and the value of the machinery and mining plant employed was estimated last year at 2,150,432*l.*

" The total area of the land held as claims was 100,942 acres, of which nearly one-third was last year lying idle; the computed value of the whole of the claims was, last year, 8,869,504*l.* Twelve new gold fields were discovered last year, and 329 new companies, with a nominal capital of 3,719,198*l.*, were registered during 1868.

" The aggregate value of the gold exported from Victoria to the close of 1868, was 147,342,767*l.* The total quantity of gold exported from Queensland in the six months ending 3rd June, was 67,080 oz., or at the rate of 11,180 oz. per month. If the exports continue at the same rate for the remainder of the year, they will amount in value to upwards of 500,000*l.* for the whole of 1869. The exports for the second quarter of this year showed, however, the slight decline of 657 oz.

" The immense wealth of the Thames gold fields, in the northern island of *New Zealand*, has given a great stimulus to gold prospecting in other districts of that colony. Thus, in Taranaki, Napier, and Wellington prospecting parties are at work, and substantial success is confidently anticipated. Although gold-bearing quartz has not yet been discovered in the province of Canterbury, the existence of extensive reefs on Banks's Peninsula has been clearly proved, and these will be shortly tested. Prospecting parties are out in the southern, western, and northern parts of the province, and a thorough exploration, at any rate, will be the result."

XI.—*Opium in China.*

From the *Times:*—

"It appears from this year's (1869) consular reports from China, that the consumption of opium in that empire is increasing, and that there is an increased growth of opium in China itself. Early in the year an imperial decree was issued, strictly prohibiting the cultivation of the poppy plant in the Chinese empire, and alleging that there would be danger of its interfering with the growth of food, and causing a scarcity of the means of subsistence; the apprehension of loss of tariff duty by a lessened importation of Indian opium may, perhaps, have been an influential reason for the decree. It threatens offenders with merited punishment, but attaches no specific penalty to disobedience; and it is thought that this decree will have no more effect than that of 1865 to the same purport, and that it will most likely be chiefly used by officials as an occasion for extorting money from the pockets of producers.

"There is evidence of extensive poppy cultivation in several parts of China. It has spread rapidly within the last few years in the vast region of Eastern Mongolia and Northern Manchuria, and is thence brought down to the coast, competing with Indian opium in the Newchang market. Opium is grown also in several southern provinces. It has been grown for years in the extreme south-west, in the province of Yunnan, the larger proportion of which has thrown off its allegiance, and is now practically an independent kingdom, governed by a Mahomedan, named Tu Wen-hsin, said to be styled by his subjects the 'Hsi-Mi-Kuo-Wang,' or 'King of the Consolidated West,' and who has established his court at Taili-fu, not far from the frontier of Burmah, called by the Chinese 'Mien-tien.' Mr. Mongan, the British consul at Tien-tsin, states that opium is brought into that port either crude or prepared. In the former state it is generally spoken of as 'tu,' earth, or clay, from its resemblance to lumps or cakes of common clay; and the native, as distinguished from the foreign, which is termed 'yang-tu,' or foreign earth, is called 'hsi-tu,' or western earth, a name which seems to have a geographical reference to producing provinces. Prepared opium, called 'ya-pieu-kao,' is at Tien-tsin generally composed of foreign and native drug boiled down, and often largely adulterated with glutinous substances, such as a decoction of the berries of a leguminous tree called the 'huai-shu,' which grows abundantly in that part of the country. In quality some of the Chinese opium is not much below Malwa; but it is inferior in strength and flavour, and smokers prefer the Indian drug, although its price may be double that of the native; and in fact, the latter is chiefly used for mixing with the former, seven-tenths foreign to three-tenths native."